Types of Lenses- Converting Bifocal Lenses to Task Specific Eyewear

By

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What is a Prescription?

- According to Wikipedia
- An **eyeglass prescription** is an order written by an eyewear prescriber, such as an optometrist or ophthalmologist, that specifies the value of all parameters the prescriber has deemed necessary to construct and/or dispense corrective lenses appropriate for a patient.

What is a Prescription?

- According to Dictionary of Ophthalmic Optics
- The formula determined by an examiner to correct refractive anomalies in an individual patient, usually containing sphere power, cylinder and prism powers, and their direction as indicated.

What is a Prescription?

- According to Dictionary of Ophthalmic Optics
- Other special instructions are part of the prescription.
- Prescription components may deviate from objective or instrumental findings based on tolerance of base curve, previously worn prescription, estimation of patient's tolerance for change, special work or avocational needs of the patient, request of the patient for near or distant lens only, type of lens mounting, and relation of spherical element to state of accommodation and muscle balance.

What is a Prescription?

- What can we do with it?
  - SV
  - Multifocal
  - PAL's
  - Various combinations

Categories of Lenses

- Two categories
- Sphere
  - Plus
  - Minus
- Compound
  - Sphere & Cylinder
  - Sphero-cylinder

Multifocals

Bifocals

- Conventional
- Flat Top/Straight Top
- Round Seg
- Executive
- Franklin Seg
- Molded front
- Powers generated on back surface

Trifocals

- Conventional
- Flat Top/Straight Top
- Executive
- Molded front
- Powers generated on back surface

Progressive Addition Lenses

- Conventional
- Molded front
- Powers generated on back surface

- In general, harder PAL designs:
  - Provide wider fields of view
  - Require less head and eye movement
  - Provide more swim and blur
- In general, softer PAL designs:
  - Provide reduced levels of astigmatism and swim
  - Limit the size of the zones of clear vision
  - Require more head and eye movement
- Modern PALs are seldom absolutely “hard” or absolutely “soft”
  - Many recent PAL designs incorporate the best balance between these two design

Progressive Addition Lenses

- Digital
- Molded front
- Powers generated on back surface

- Digital
- Digitally designed front
- Digitally designed back

Analyzing and Interpreting a Prescription

- What is the prescription formula?
- What is the intended use of the eyewear
  - Fit
  - Function
  - Fashion
- Ask enough questions to ensure that you understand the intended use
  - Lifestyle dispensing

The Prescription

- Prescriptions come in all types. This is a fairly typical prescription. It indicates that the patient is myopic, with an astigmatism.

	Sphere	**Cylinder**		**Axis**
OD	-2.25	-1.50	X	180
OS	-3.00	-1.50	X	180

Optical Cross

- There are a number of uses for an optical cross.
- The purpose that we will use here is to identify the powers on a lens in its two principle meridians.
- An optical cross is a graphic depiction that illustrates the powers of a lens in the two principle meridians, which, on a lens are surfaced 90° apart.
- In order to understand exactly how a prescription relates to the lens, and how it will make the finished product look, we need to place it on an optical cross, which is sometimes referred to as a lens cross.

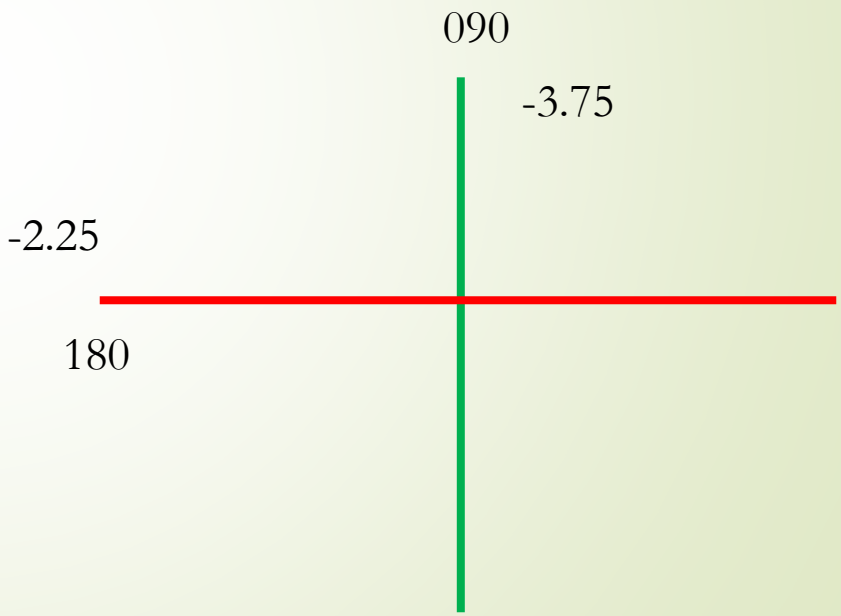
Optical Cross

OD -2.25 -1.50 X 180

Placed on the optical cross

The sphere relates to the axis although the sphere is throughout the lens. So the power at 180 is -2.25

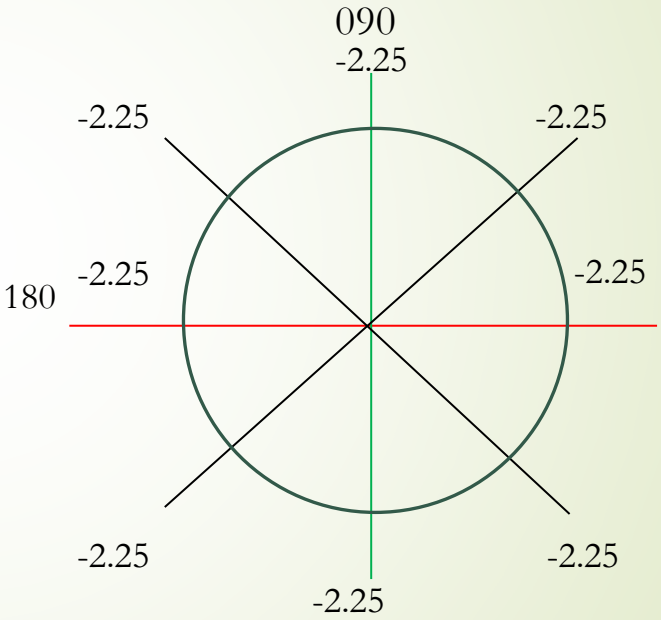
The cylinder power is at 100% of its power 90 degrees away from the axis and is added to the sphere. In this case the sphere power is -2.25 and the cylinder power is -1.50 which added together becomes -3.75. So the power in the 90th meridian is -3.75



Optical Cross

-2.25 -1.50 X 180

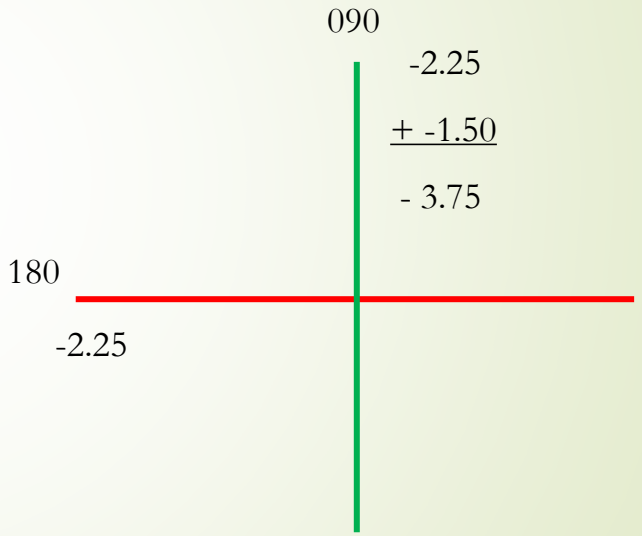
- Let's look at it another way.
- The sphere power is throughout the lens, so it's everywhere.
- The sphere power of -2.25 is throughout the lens



Optical Cross

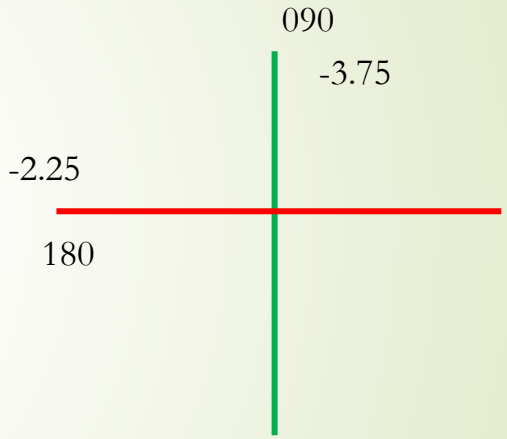
-2.25 -1.50 X 180

- In a lens that also contains a cylinder, the only place that just the sphere power is located is at the meridian of the axis, which in this example is the 180th meridian.
- 90 degrees away, the full power of the cylinder is added to the sphere power.
- So the power at the 90th meridian is the combination of the sphere power of -2.25 plus the cylinder power of -1.50 which equals -3.75



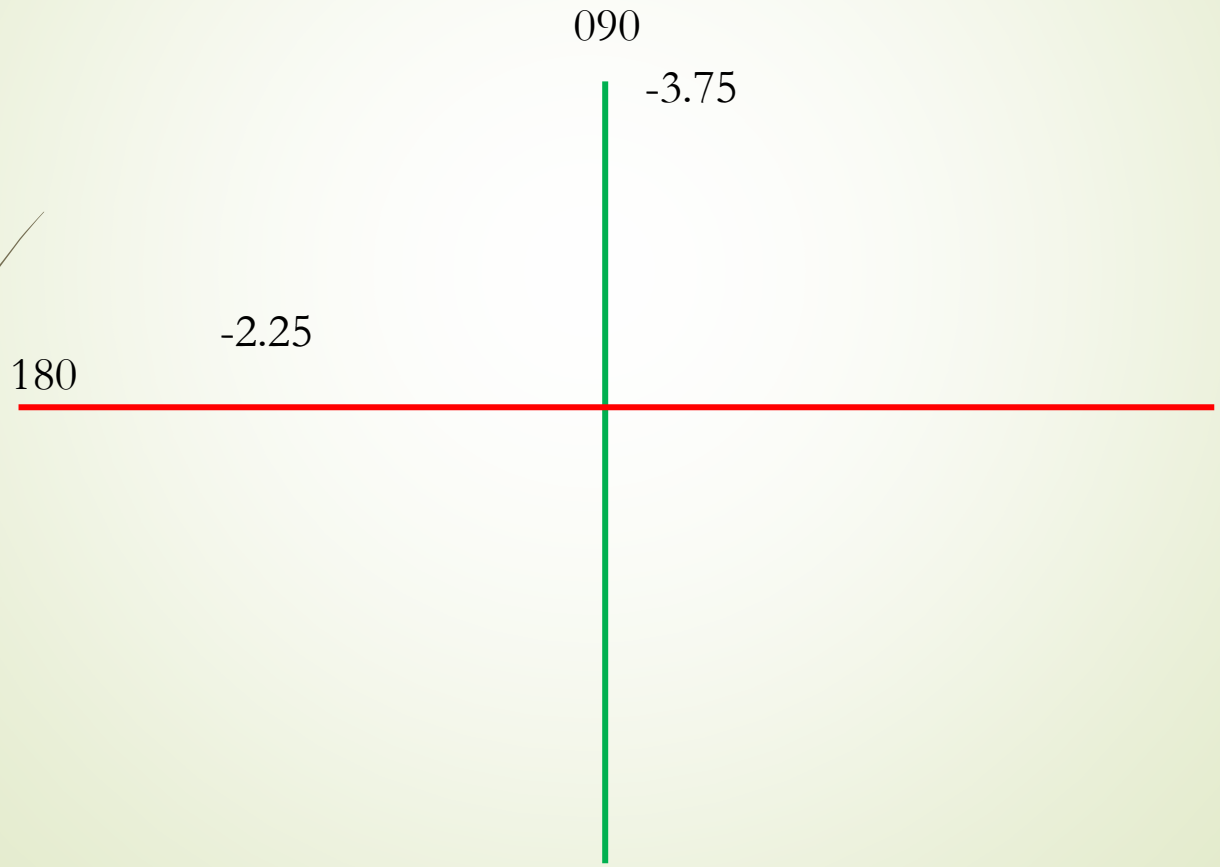
Types of Refractive Errors

- -2.25 -1.50 X 180
  - This type of refractive error is Compound Myopic Astigmatism
  - Both principle meridians are in minus power form on the lens cross.
    - That means that both principle points of focus are in front of the retina

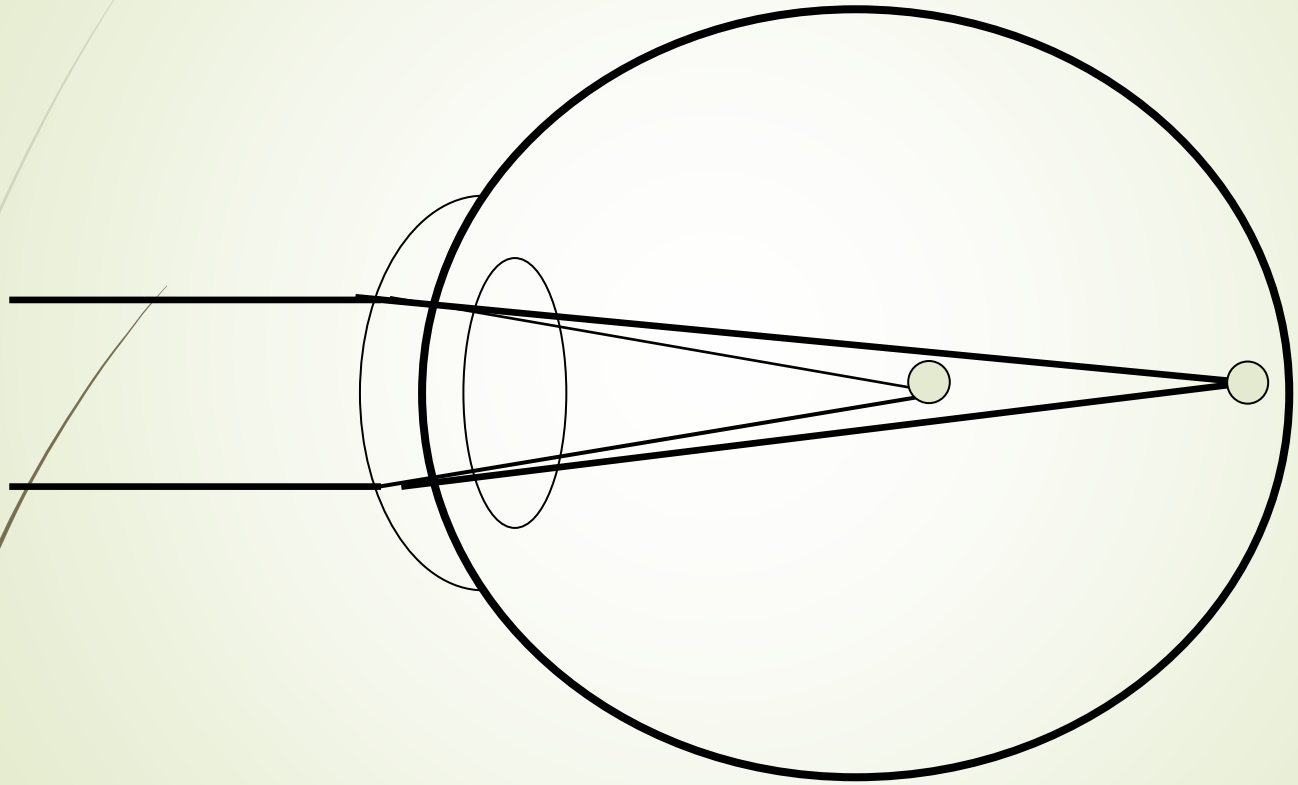


Compound Myopic Astigmatism

-2.25 – 1.50 X 180

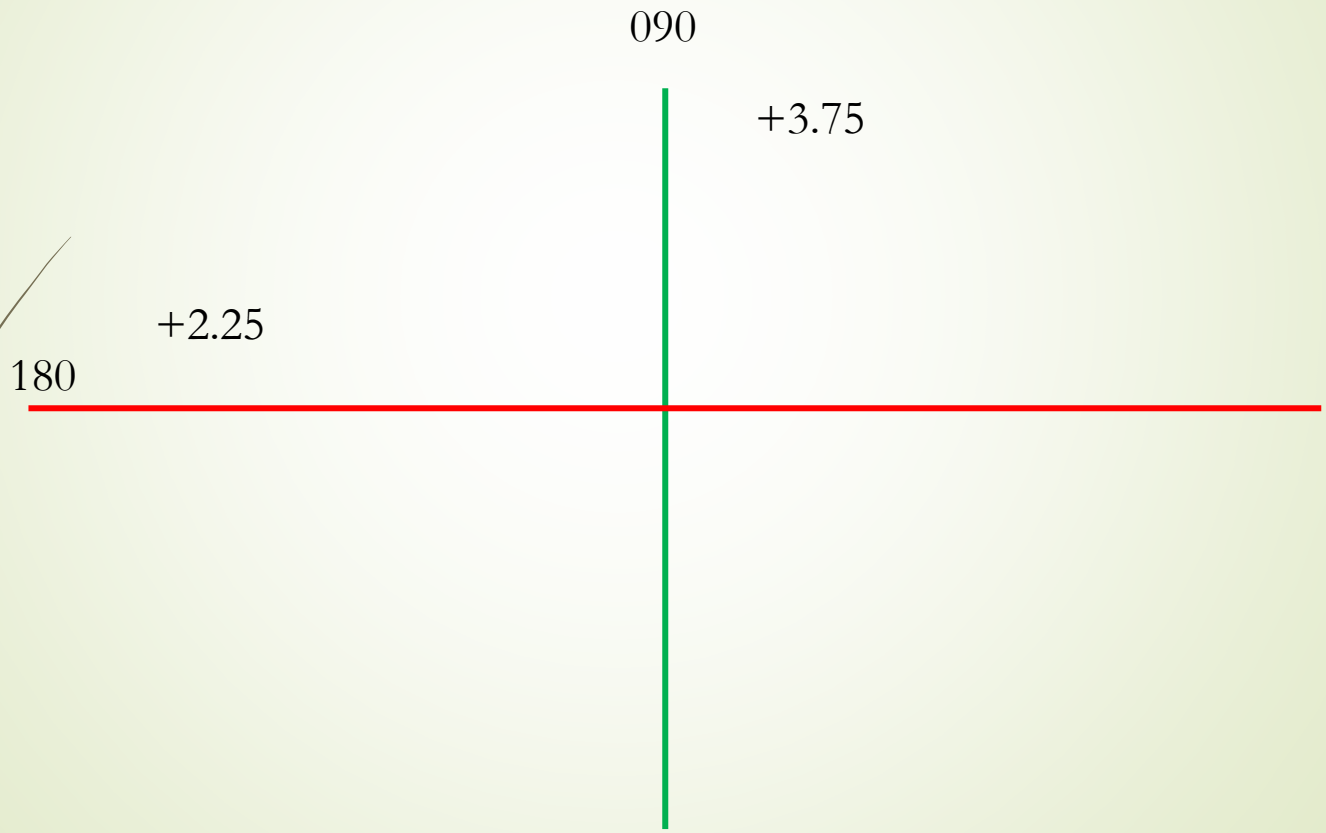


Compound Myopic Astigmatism

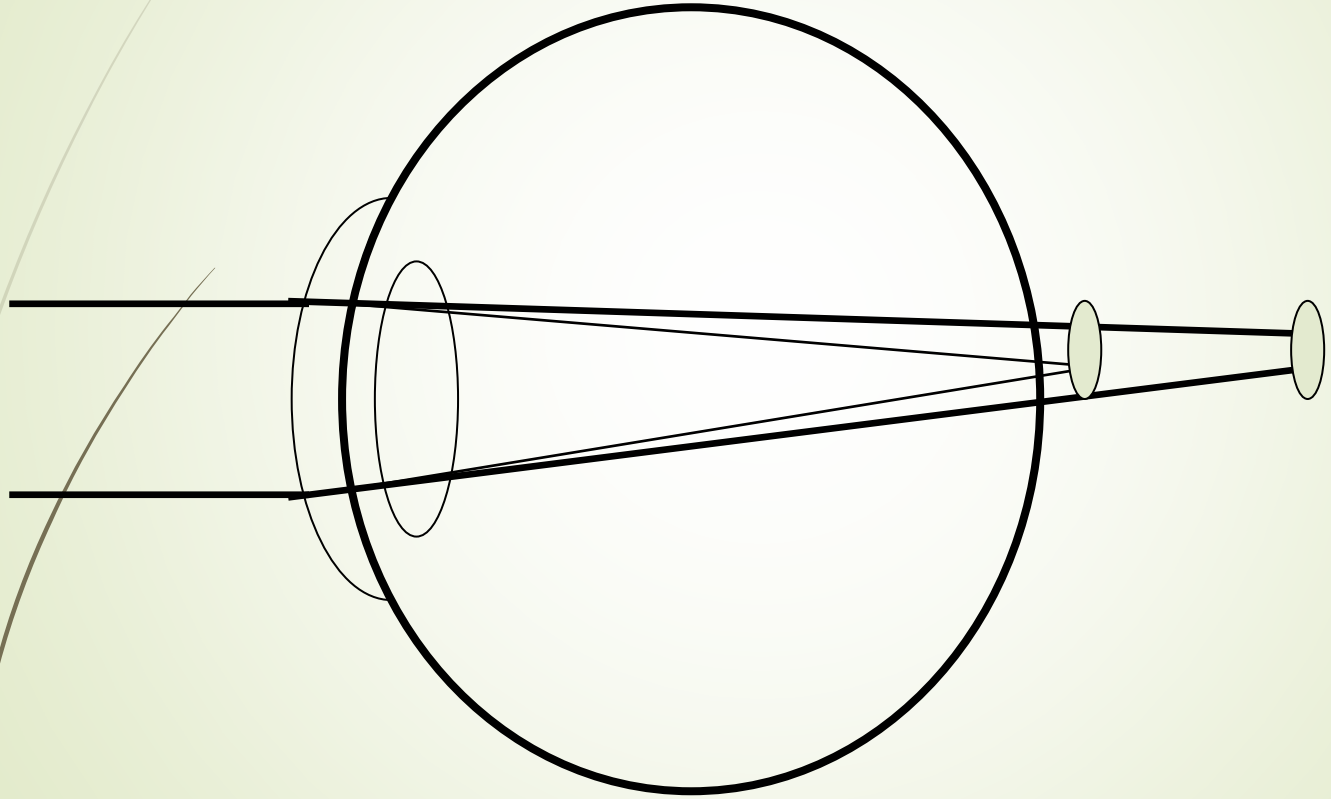


Compound Hyperopic Astigmatism

+2.25 + 1.50 X 180

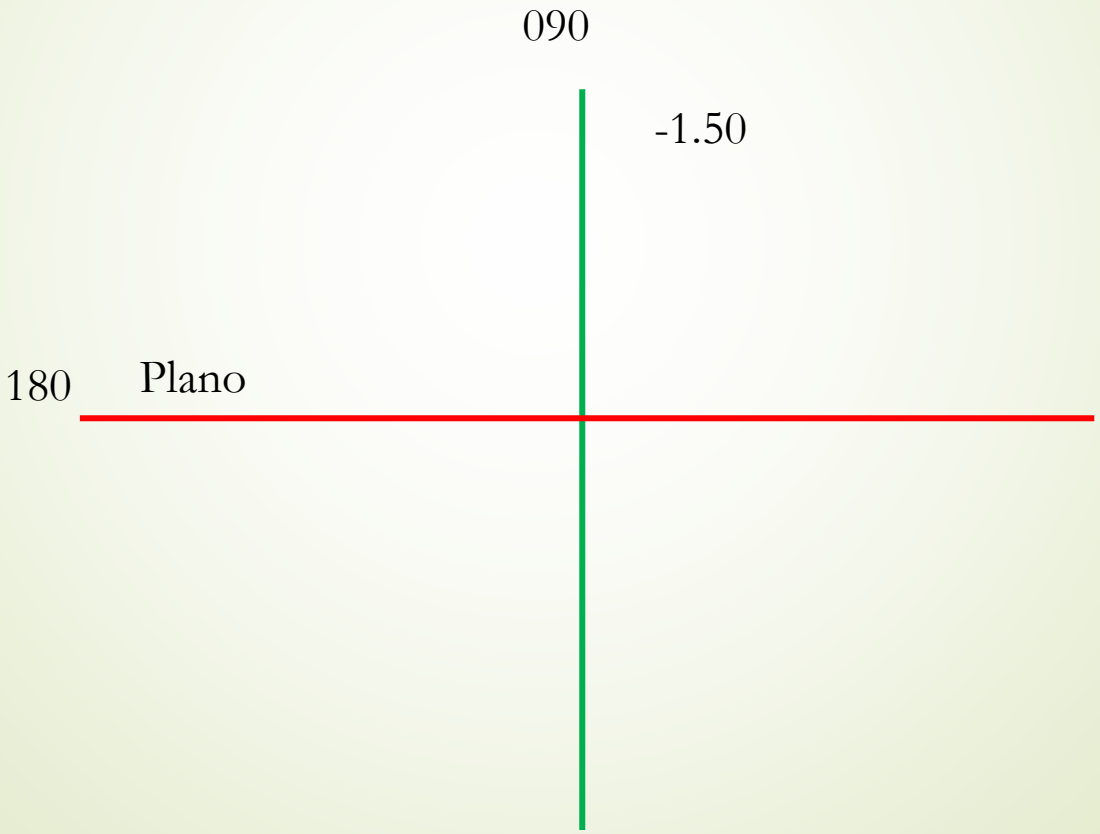


Compound Hyperopic Astigmatism

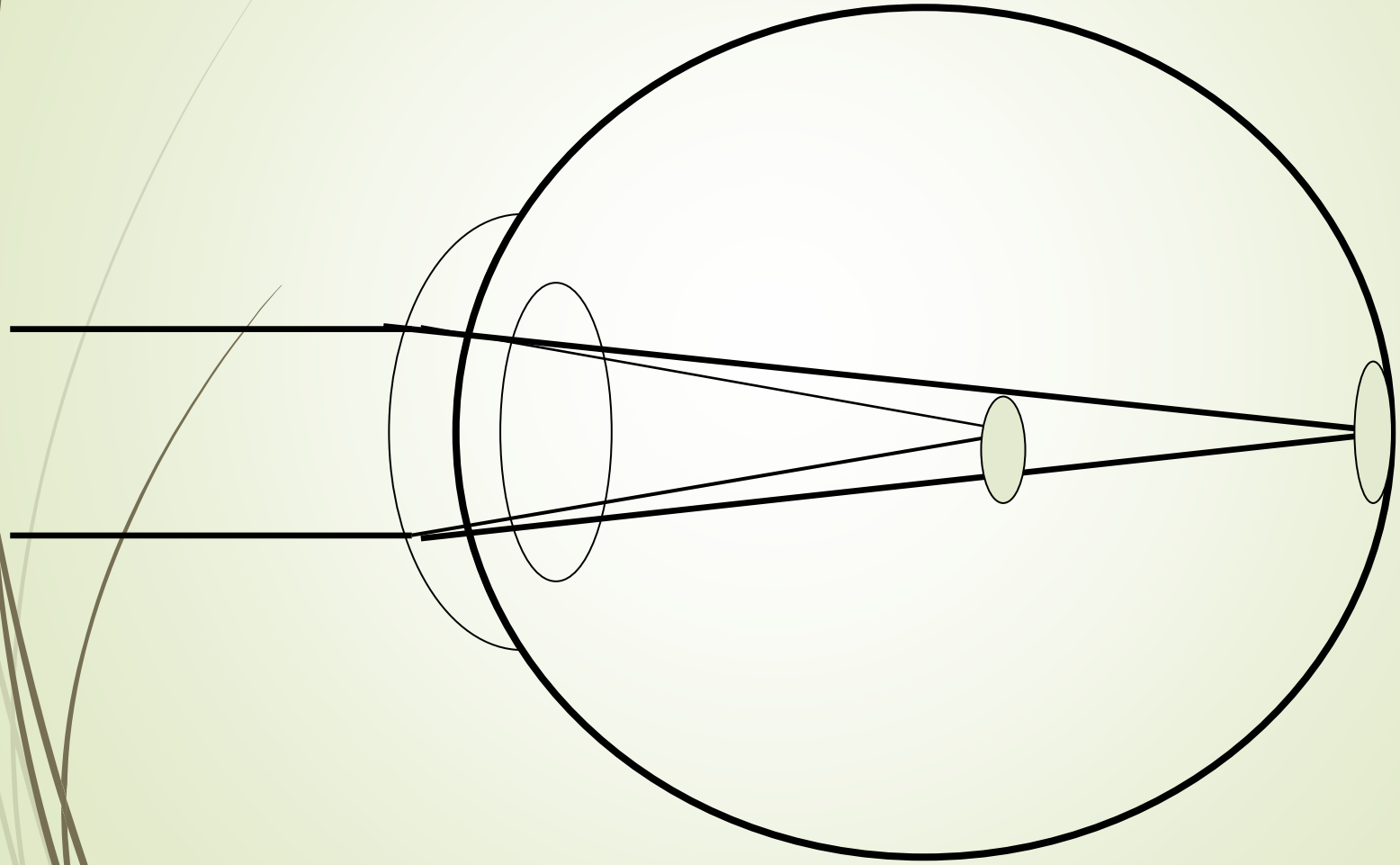


Simple Myopic Astigmatism

Plano - 1.50 X 180

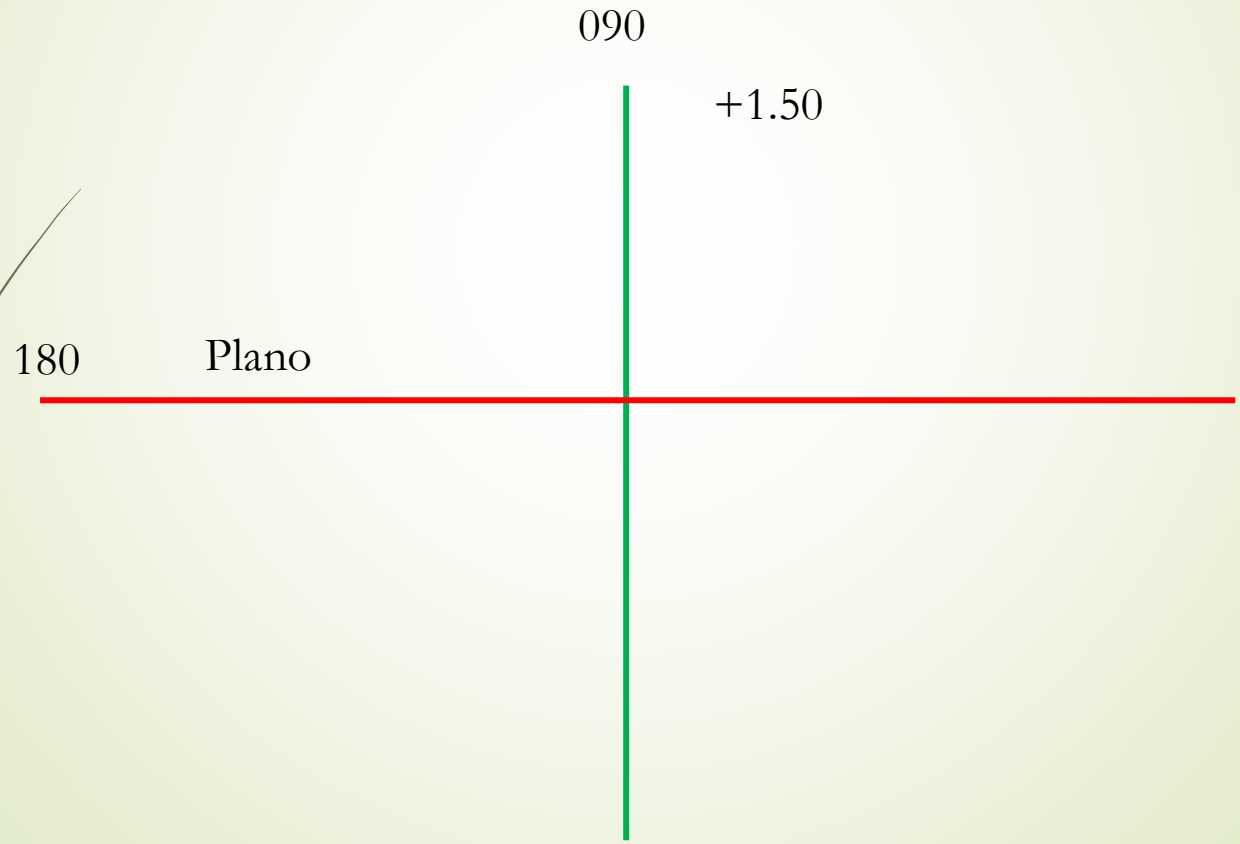


Simple Myopic Astigmatism

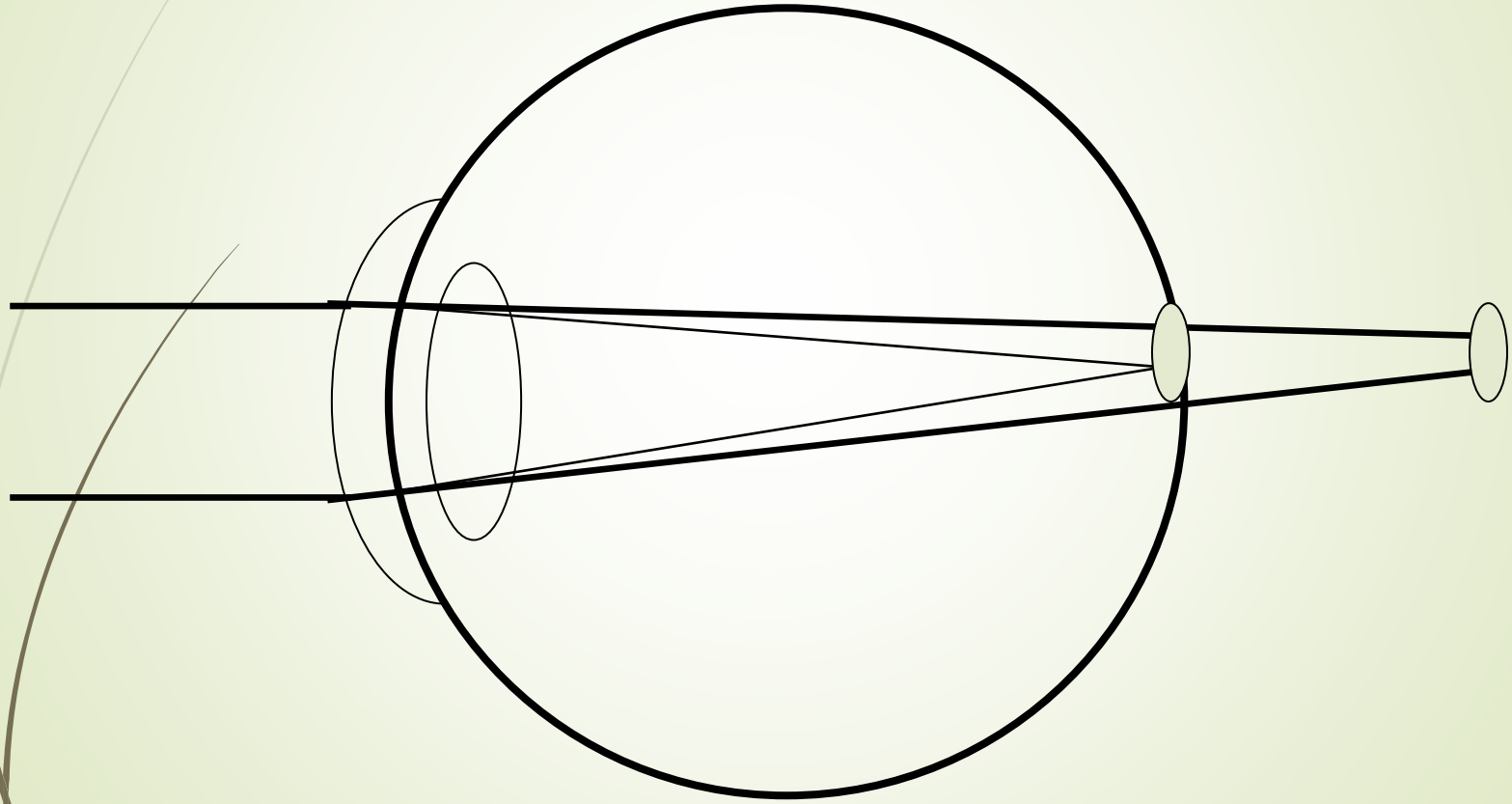


Simple Hyperopic Astigmatism

Plano + 1.50 X 180

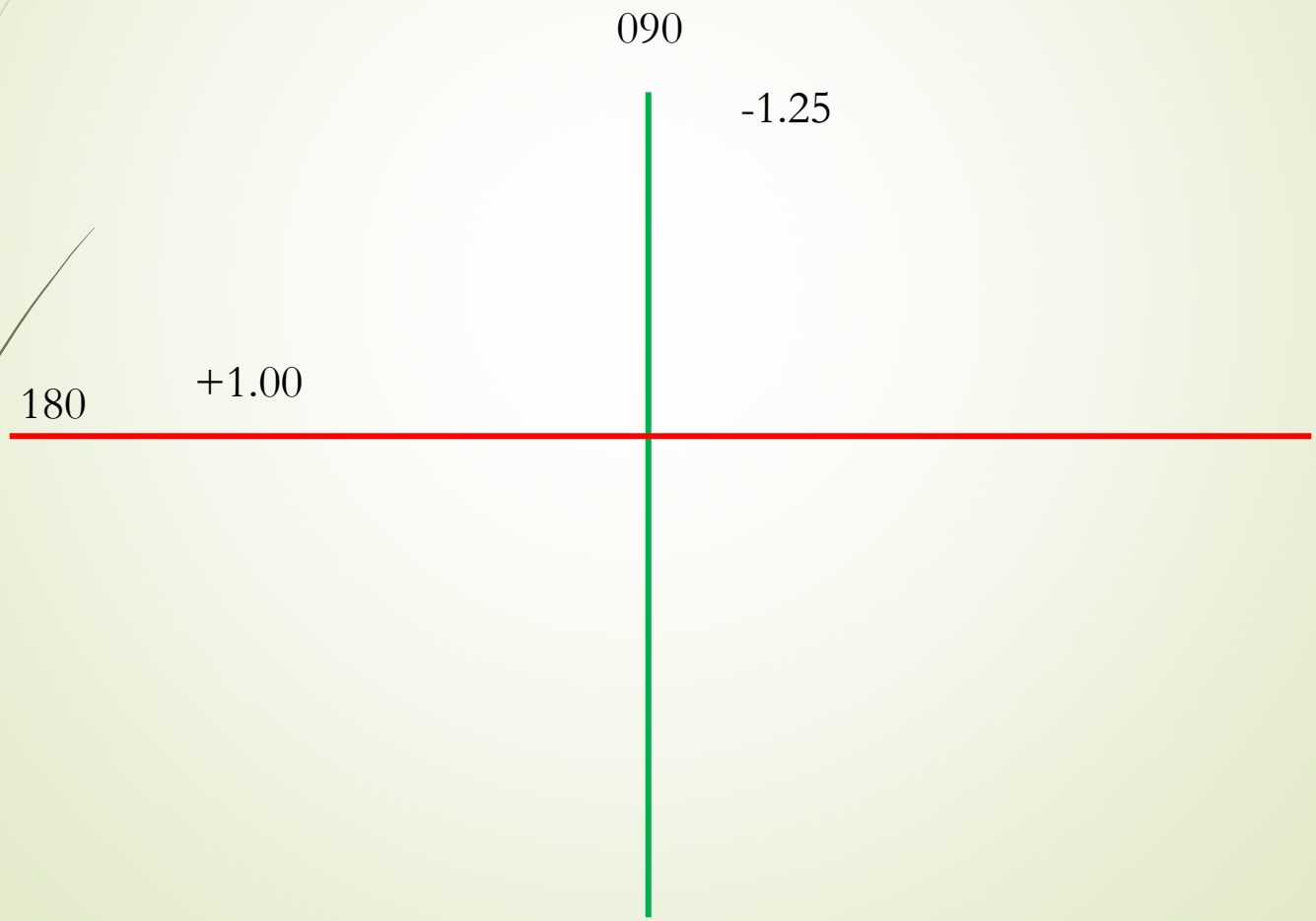


Simple Hyperopic Astigmatism

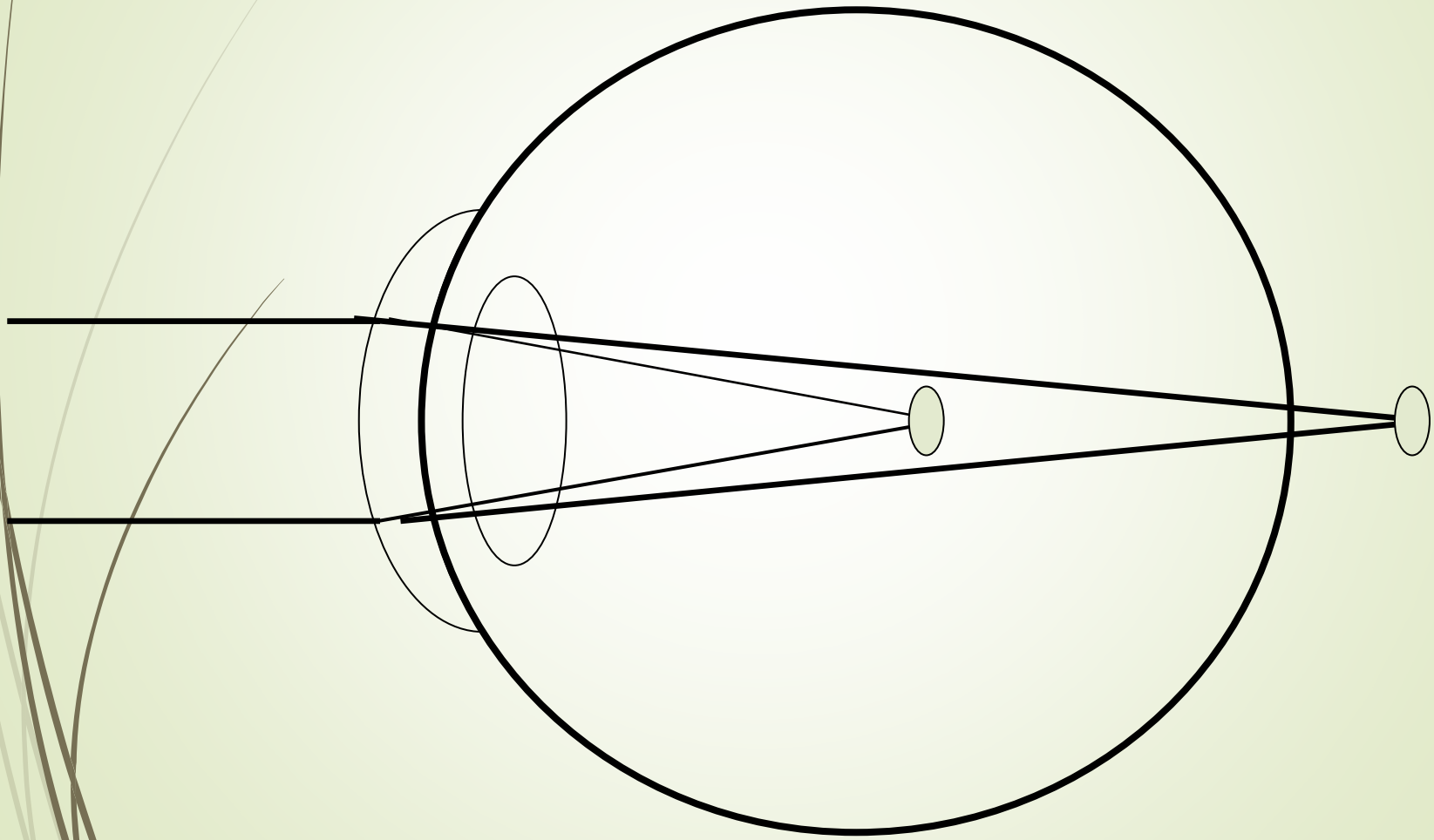


Mixed Astigmatism

+1.00 –2.25 X 180



Mixed Astigmatism

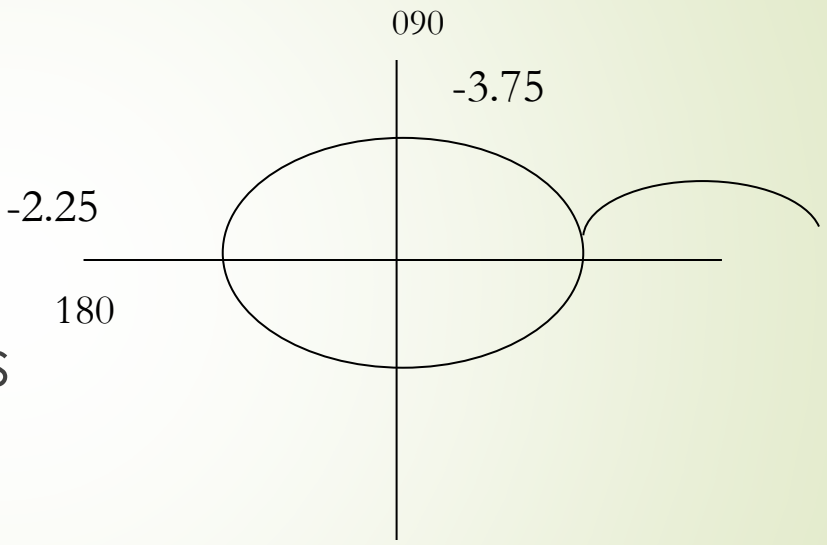


Lens Cross

OD -2.25 -1.50 x 180

In order to visualize how the prescription will look in glasses, simply draw an oval, square or circle around the lens cross and that becomes the lens

Now you can see where the thickness will be and where it will be thinner



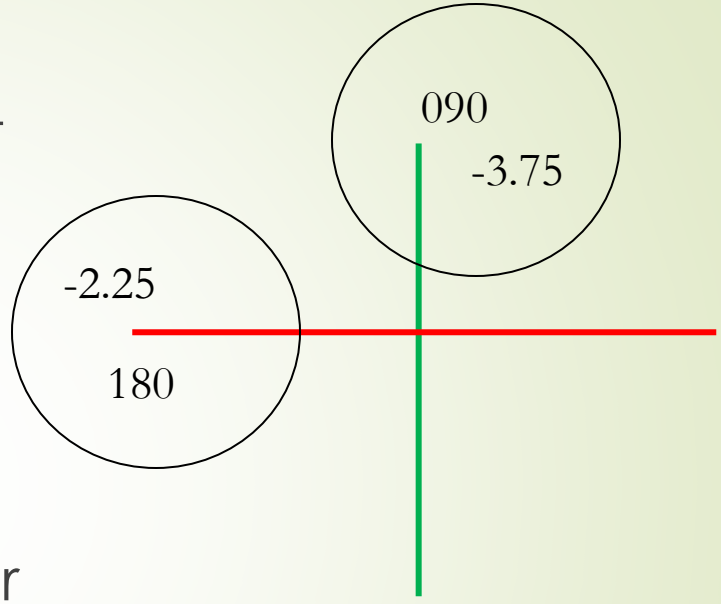
Transposition

- It's important to remember that transposition doesn't change the value of the lens, it simply changes the form that the prescription is written in
- Remember the lens cross???
- Regardless of whether the Rx is written in + cylinder or – cylinder the powers remain the same in any meridian on the lens cross.
- This prescription can be written

  -2.25 – 1.50 x 180 or

  -3.75 + 1.50 x 090

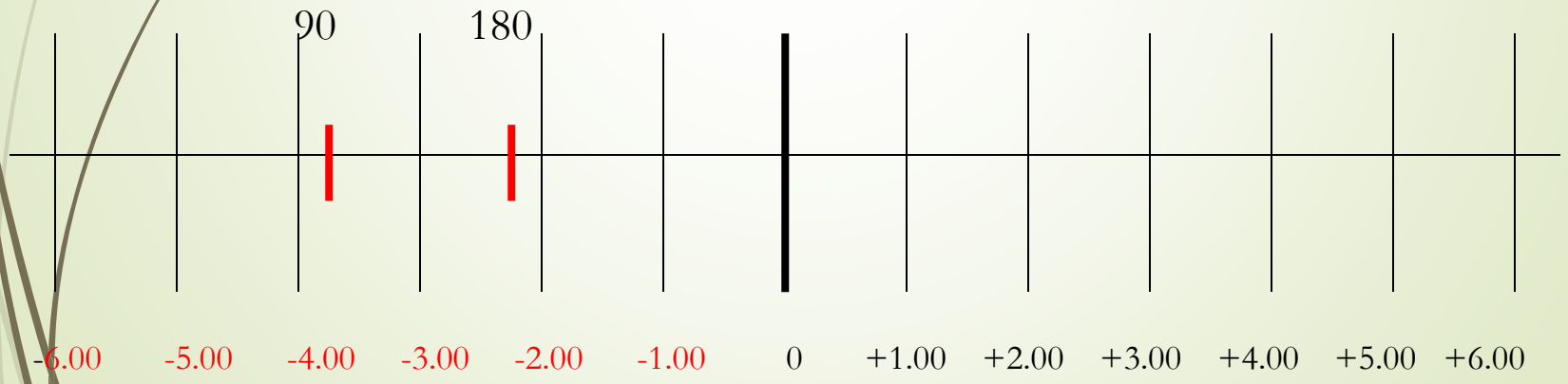
  It's the same lens



-2.25 @180/-3.75@090

Transposition

- Using the number line as though it were on a lens meter, take the same prescription and orient it here
- If you rotate the axis wheel to 180 meridian, the sphere lines will come clear at -2.25 and 90 degrees away at the 90 meridian the cylinder lines will be clear at -3.75



Transposition

- When discussing changing a prescription that is written in plus cylinder form to minus cylinder form, we use the term Flat Transposition, or as it has been more commonly shortened Transposition.

- This changes the format without changing the value of the prescription.

Designation of Axis in Rx

- When observing the written form of the prescription you may observe that it can be written with the axis as cx

  -2.25 – 1.50 cx 180 or

  -3.75 + 1.50 cx 090

- Or you may observe that it is written with the axis reference as simply x

  -2.25 – 1.50 x 180 or

  -3.75 + 1.50 x 090

Flat Transposition

- Prescriptions can be written in both plus and minus cylinder form.

  -2.25 – 1.50 x 180 or

  -3.75 + 1.50 x 090

Flat Transposition

- -2.25 – 1.50 x 180
- Step 1
  - Algebraically add the cylinder power to the sphere power. This becomes the new sphere power

  -2.25 + - 1.50 = - 3.75

  The new sphere power is -3.75

Flat Transposition

- -2.25 – 1.50 x 180
- Step 2
  - Change the sign of the cylinder power to the opposite sign; if it's plus change it to minus and if it's minus change it to plus. The numerical power remains the same

  -1.50 becomes + 1.50

  The new cylinder is + 1.50

Flat Transposition

- -2.25 – 1.50 x 180
- Step 3
  - If the axis is 091 to 180, subtract 90 from the axis
  - If the axis is 001 to 90, add 90 to the axis
  - The axis is 180, so we subtract 090 and get 090
  - The new axis is 090 or 90
    - It is best to use three digits as that ensures that you haven't simply left something off.

Flat Transposition

- It's that simple

  -2.25 – 1.50 x 180 transposed becomes

  -3.75 + 1.50 x 090

Transposition

-2.25 – 1.50 cx 180

-3.75 + 1.50 cx 090

OR

-2.25 – 1.50 X 180

-3.75 + 1.50 X 090

- When writing an Rx containing an axis, by substituting either cx or X, you routinely drop the degree symbol
  - This helps to reduce the error of confusing it with a zero (0)

Types of Lenses

- Single Vision
- Bifocal
- Trifocal
- Progressive Addition Lenses
- Specialty
  - Occupational
  - Sports
  - Any type of task specific lenses

Single Vision

- Corrects only one type of visual error
- Single point of focus
  - Plus
  - Minus
  - Compound

Bifocal Lenses

- This is the same distant prescription but with an addition of a bifocal add

	Sphere	Cylinder		Axis
OD	-2.25	-1.50	X	180
OS	-3.00	-1.50	X	180

ADD OU +2.25

The Prescription

- In order to convert a bifocal prescription to a simple reading prescription, you simply add the ADD power to the spherical component of the distant Rx.
- Leave the cylinder and the Axis alone

	Sphere	**Cylinder**		**Axis**
OD	-2.25	-1.50	X	180
OS	-3.00	-1.50	X	180

ADD OU +2.25

The Prescription

	Sphere	Cylinder		Axis
OD	-2.25	-1.50	X	180
OS	-3.00	-1.50	X	180

ADD OU +2.25

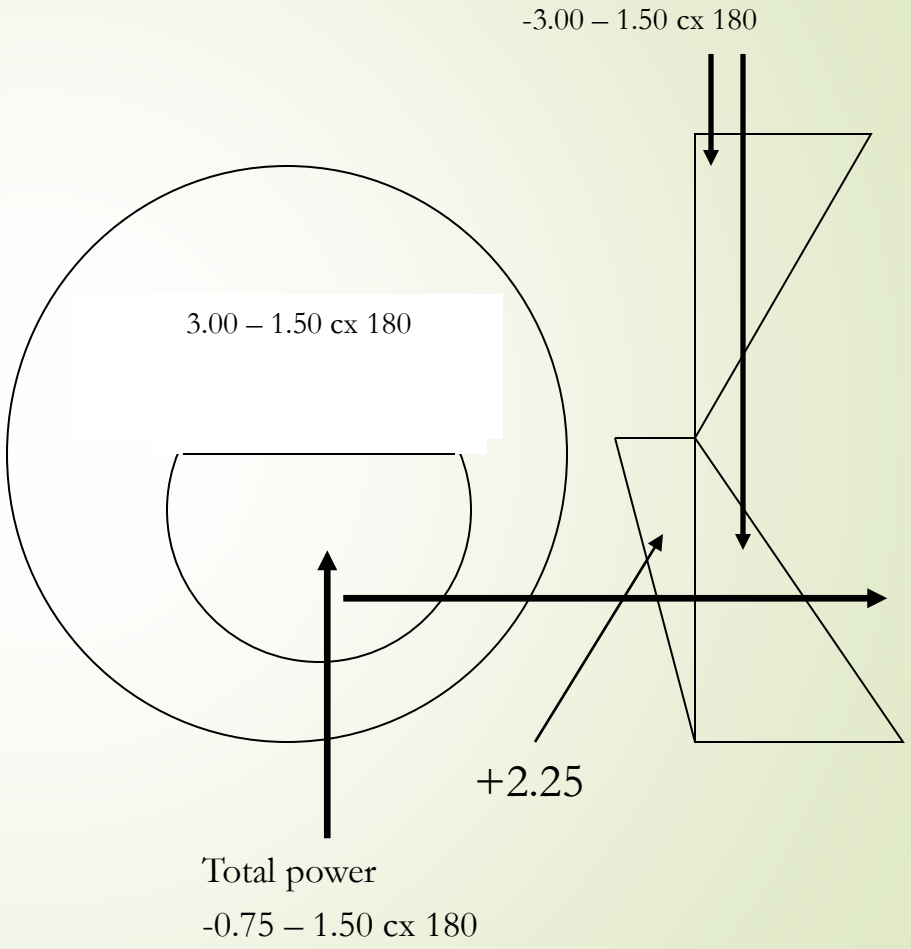
- Near vision prescription becomes

	Sphere	Cylinder		Axis
OD	Plano	-1.50	X	180
OS	-0.75	-1.50	X	180

Total Power at the Reading Level

- -3.00 – 1.50 cx 180
  Add + 2.25

- Add power combined with the distant power gives the total power to be used at near.



Reading Power

- Although you may think in terms of minus power being for distant correction, please keep in mind that sometimes it is not…as in the example that we just discussed.
- That's why it's so important to get a good lifestyle history, and observe the Rx.

Rx as written, patient wants near vision only.

-2.25 – 1.50 x 180

-3.00 - 1.50 x 090

Add +2.25 OU

Near Rx:

Plano – 1.50 x 180

-0.75 – 1.50 x 180

Reading Power

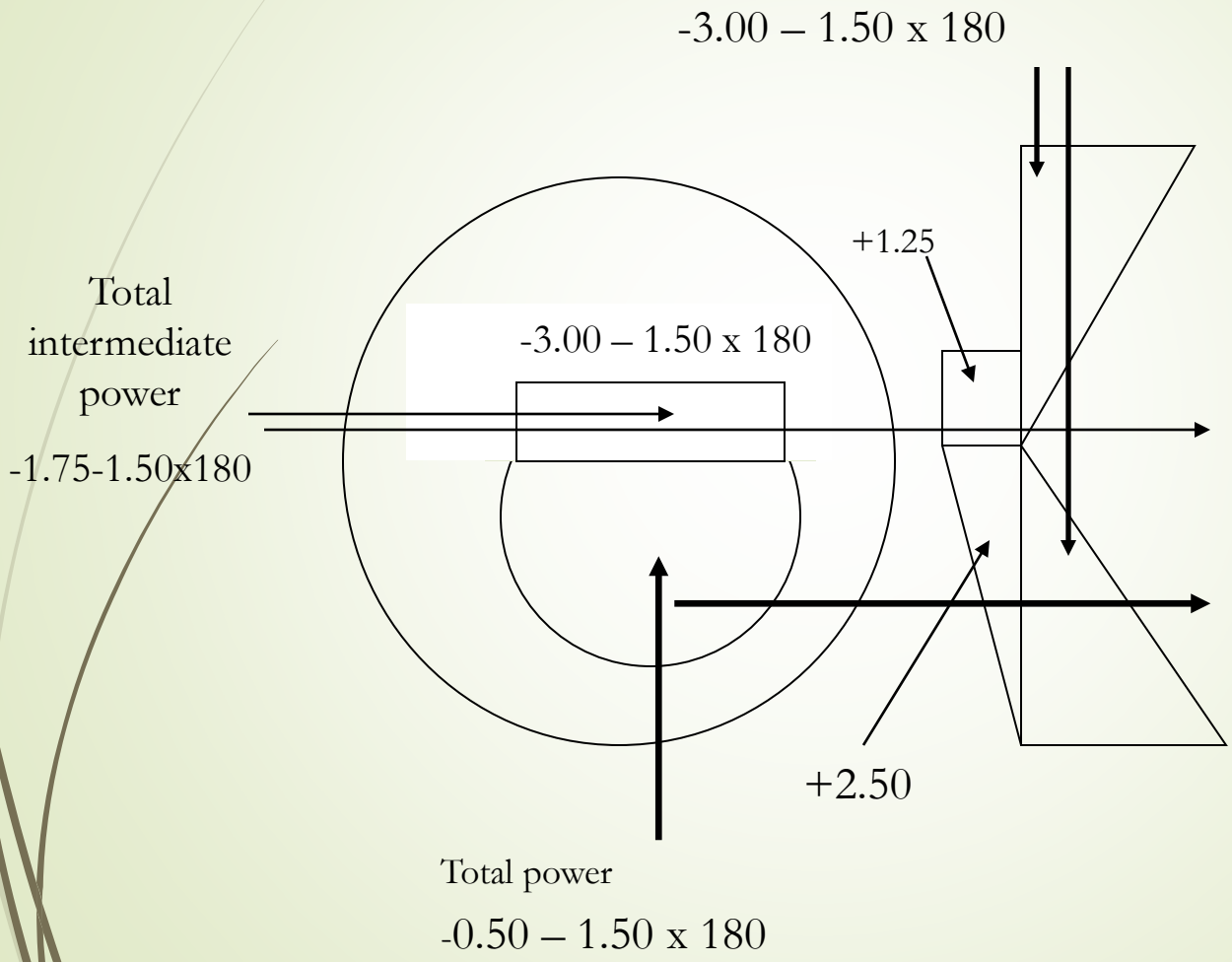
- The normal viewing distance for the average patient is computed for 16 – 18 inches away or approximately 40 cm away.

- If you need to design task specific eyewear for your patient, you will need to determine the distance and calculate the power accordingly.

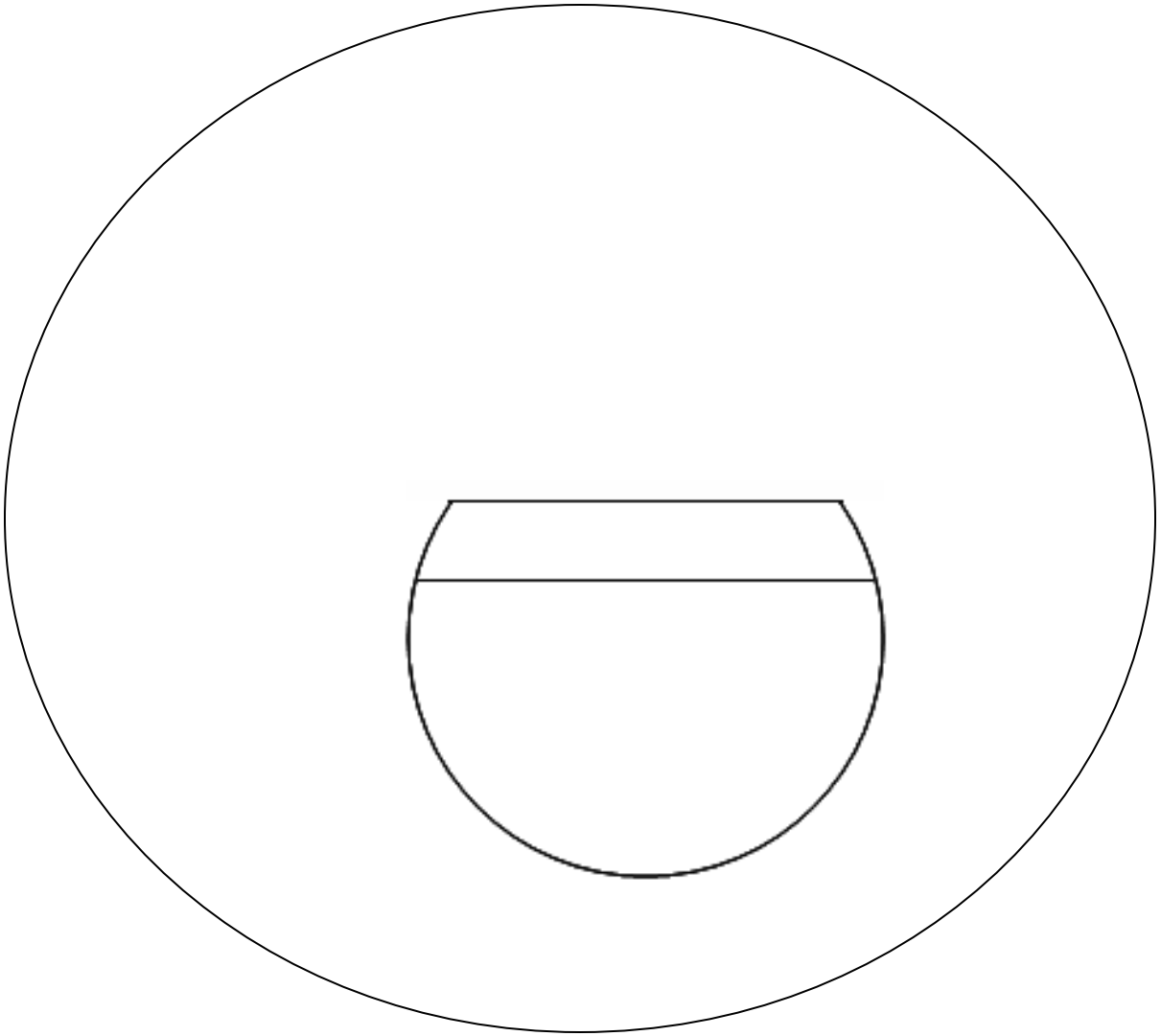
Trifocal/Intermediate Power

- The power of the intermediate portion of a standard trifocal is ½ of the power of the total add power
  - If the ADD power of an Rx is +2.50
    - The add power within the trifocal area is +1.25
- Intermediate power is usually for arms length or approximately 3 feet away.

Trifocal Power



Trifocal



Trifocal/Intermediate Power

- Given this information, if you wanted to create a pair of glasses that would be utilized for intermediate use, you would simply add ½ of the total add power to the distant component of the Rx.
  - Remember that you only add the power to the spherical component and leave the cylinder and axis the same.

Trifocal/Intermediate Power

	Sphere	Cylinder		Axis
OD	-2.25	-1.50	X	180
OS	-3.00	-1.50	X	180

ADD OU +2.50

- Trifocal/Intermediate prescription becomes

	Sphere	Cylinder		Axis
OD	-1.00	-1.50	X	180
OS	-1.75	-1.50	X	180

Distant and Intermediate Power

- Patient is a pianist
  - Needs to see music about 3 feet away
  - Needs to see conductor at normal distant
  - Is bothered by trifocals and wants bifocals

  - Simply make bifocals rather than trifocals
    - Use the intermediate add power for the bifocal add power.

Recap Types of Lenses

- Single Vision
- Bifocal
- Trifocal
- Progressive Addition Lenses
- Specialty
  - Special distances – May need authorization from Doctor
- Occupational
- Sports
- Any type of task specific lenses

Analyzing & Interpreting The Prescription

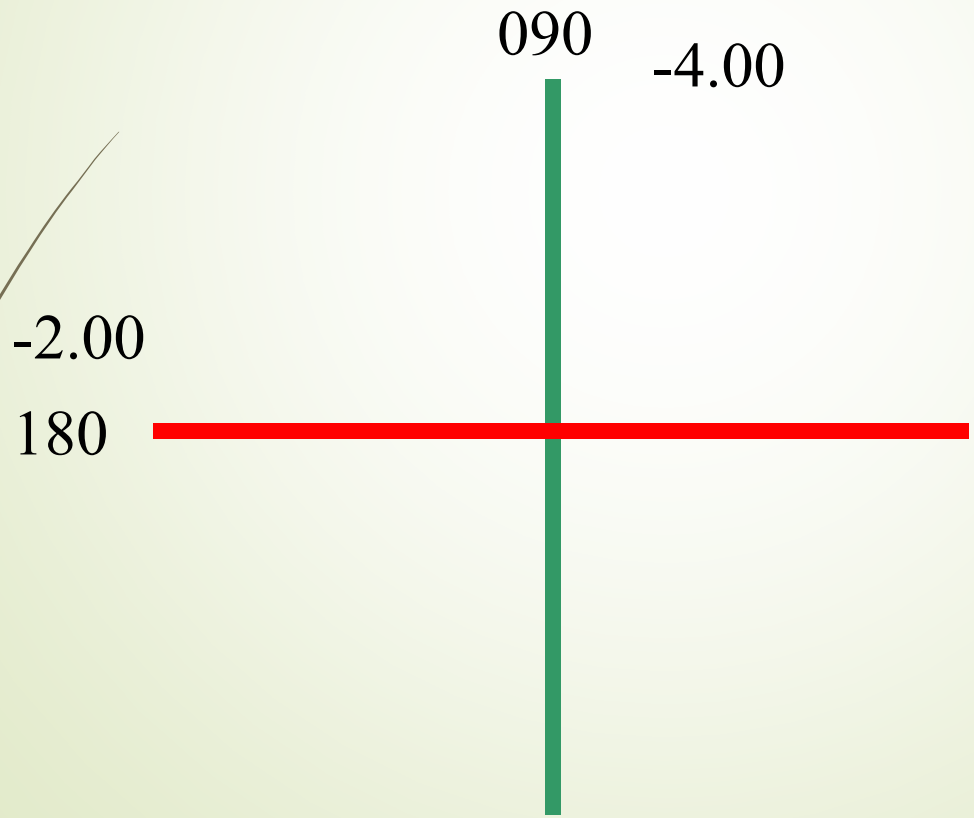
- First of all – look at the Rx
- OU -2.00 – 2.00 X 180
- Find out the intended use of the eyewear

Analyzing & Interpreting The Prescription

- Next you need to be able to identify any potential visual or cosmetic concerns
- OU -2.00 – 2.00 X 180
- Discuss any concerns with the patient
  - They want to know how they will look

Analyzing & Interpreting The Prescription

- Place the prescription on a lens cross



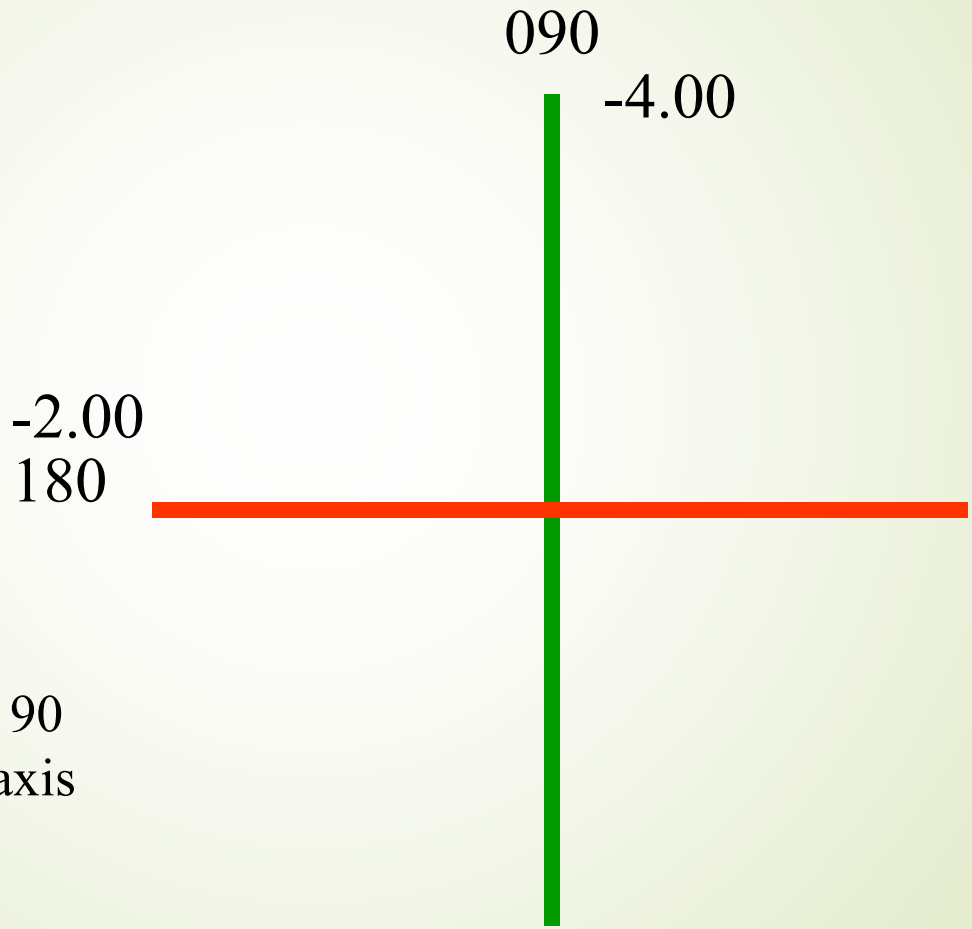
Analyzing & Interpreting The Prescription

-2.00 – 2.00 X 180

Sphere power always relates to the axis

and is everywhere on the lens

Therefore



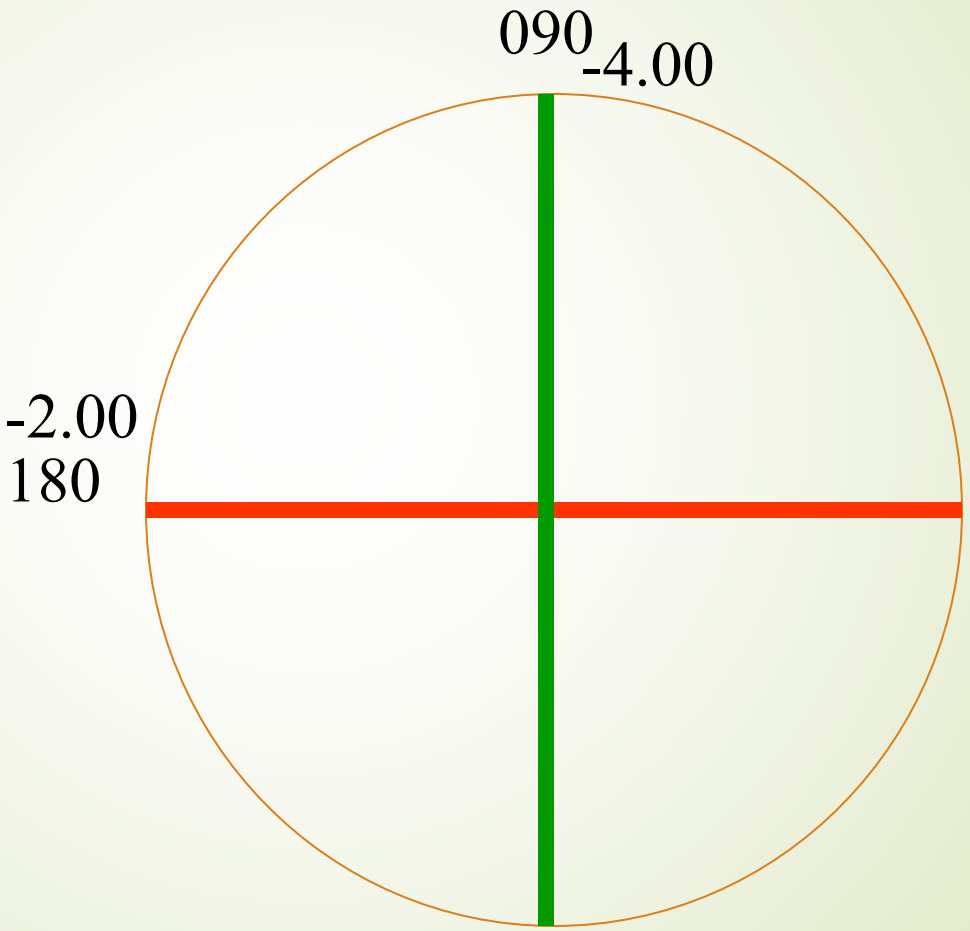
Total cylinder power is 90 degrees away from the axis

Therefore

Power on Lens Cross

-2.00 – 2.00 X 180

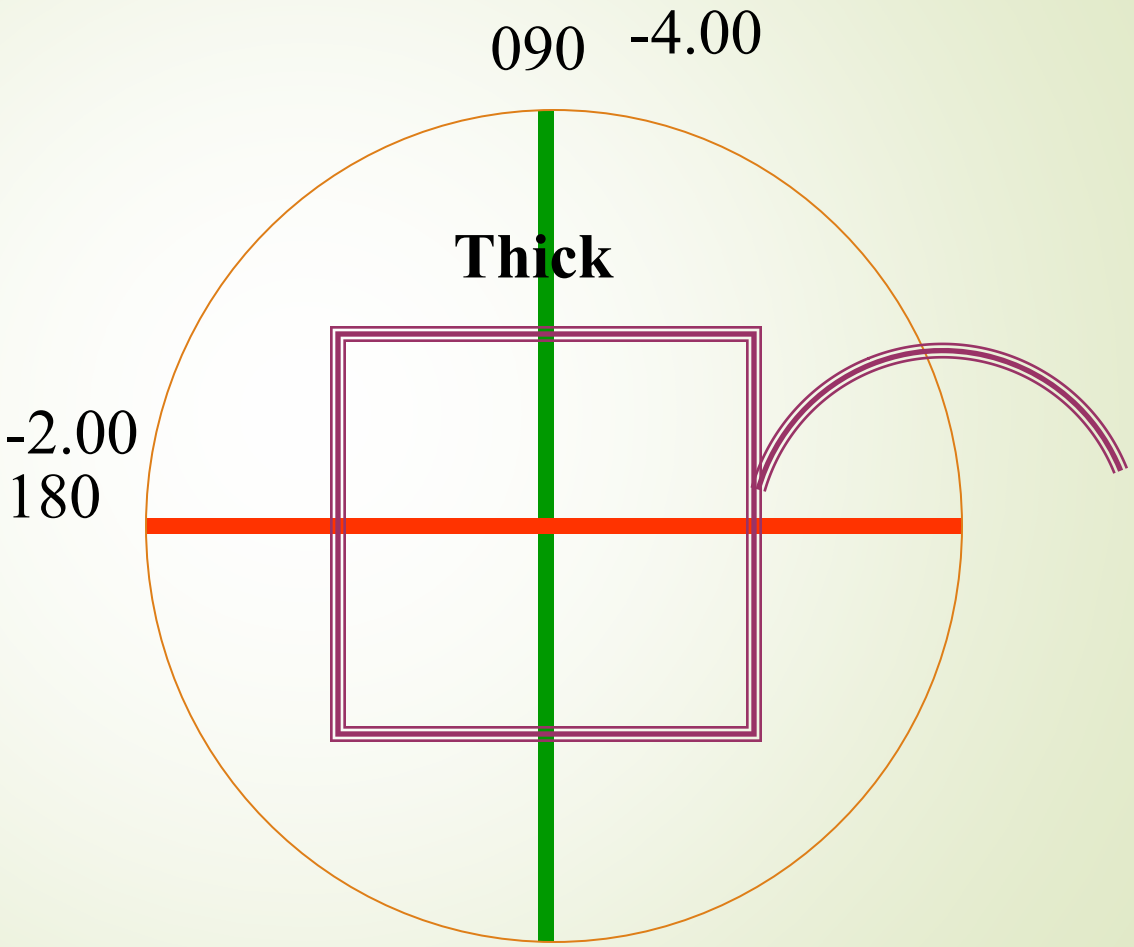
Draw a circle around the lens and you will see where it is thick and where it would be thinner



Power on Lens Cross

-2.00 – 2.00 X 180

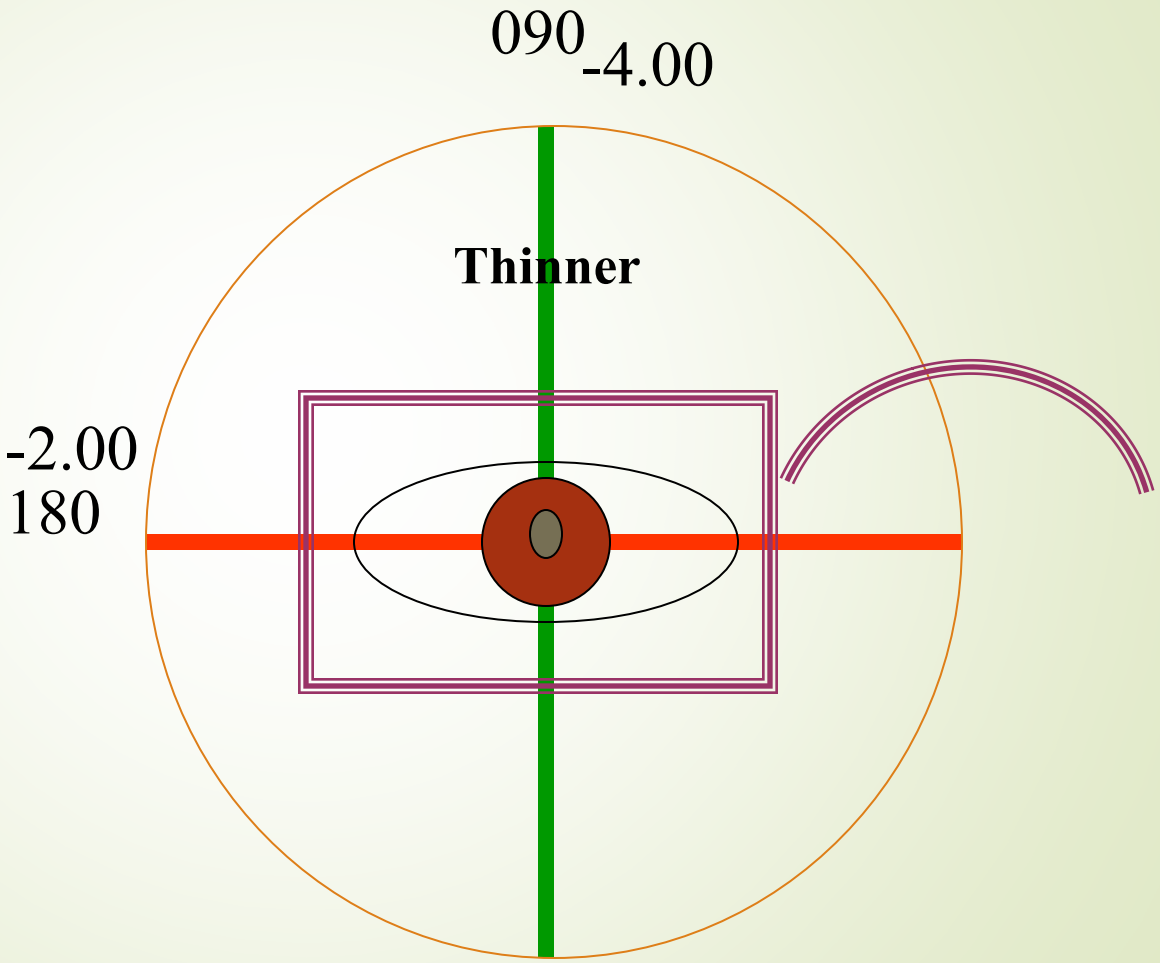
Consider shapes to affect edge thickness



Power on Lens Cross

-2.00 – 2.00 X 180

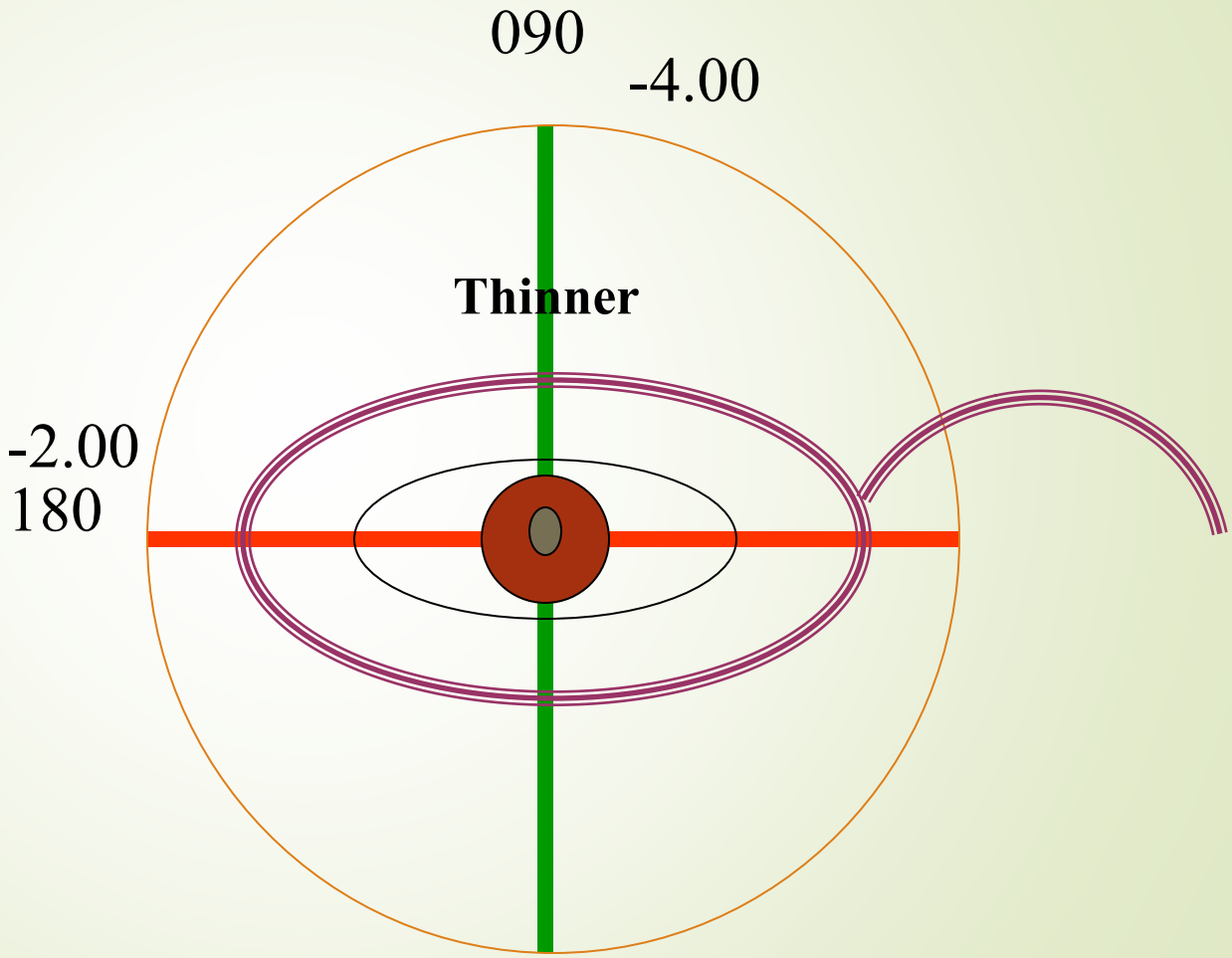
Consider shapes to affect edge thickness



Power on Lens Cross

-2.00 – 2.00 X 180

Consider shapes to affect edge thickness



Visual Concerns or Cosmetic Concerns?

OD -2.00 – 2.00 X 180

OS - 2.00 – 2.00 X 090

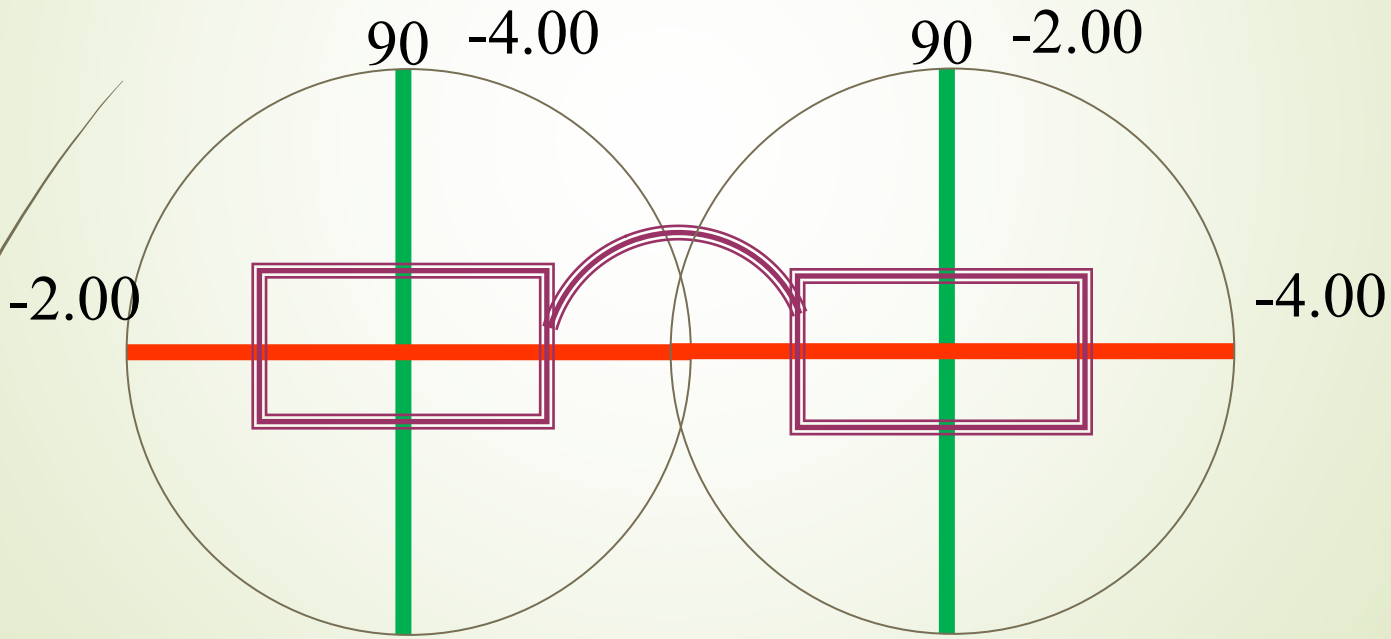
Add OU + 2.50

Cosmetic Concerns

-2.00 – 2.00 X 180

-2.00 – 2.00 X 090

Add OU +2.50

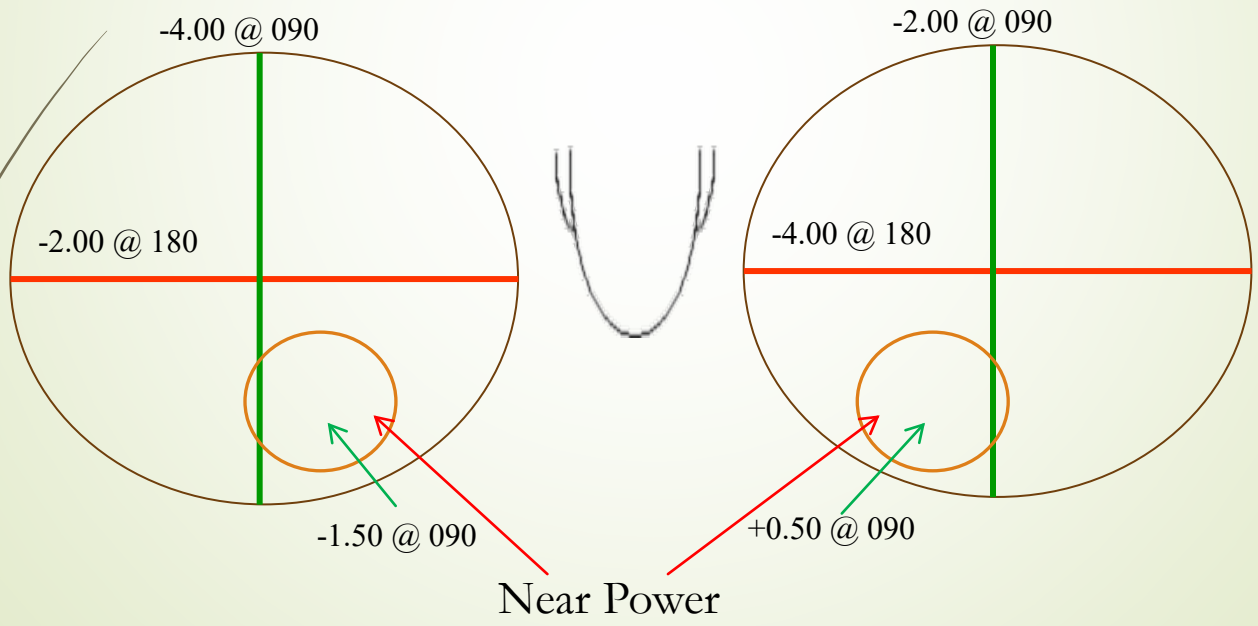


Visual Concerns

OD -2.00 -2.00 x 180

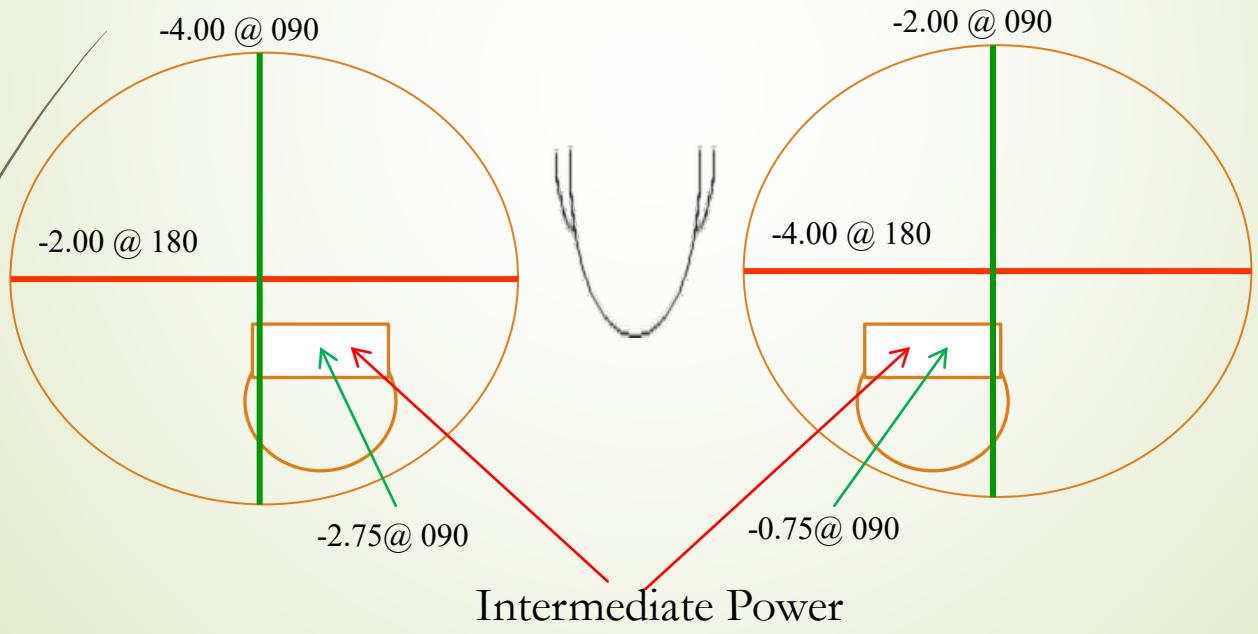
OS -2.00 -2.00 X 090

Add OU + 2.50



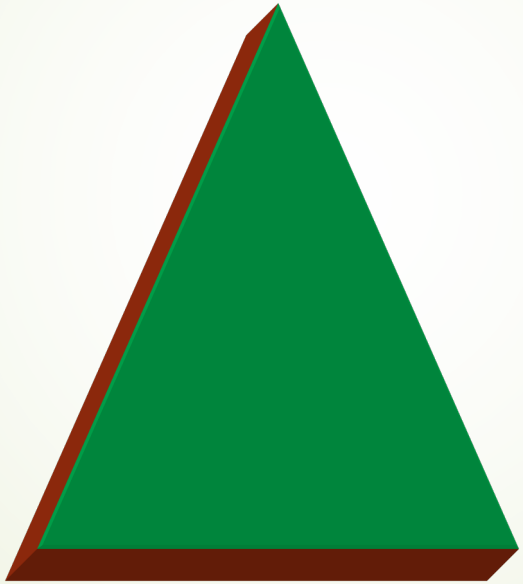
Ophthalmic prescription

- OD -2.00 -2.00 x 180
- OS -2.00 -2.00 X 090
- Add OV + 2.50



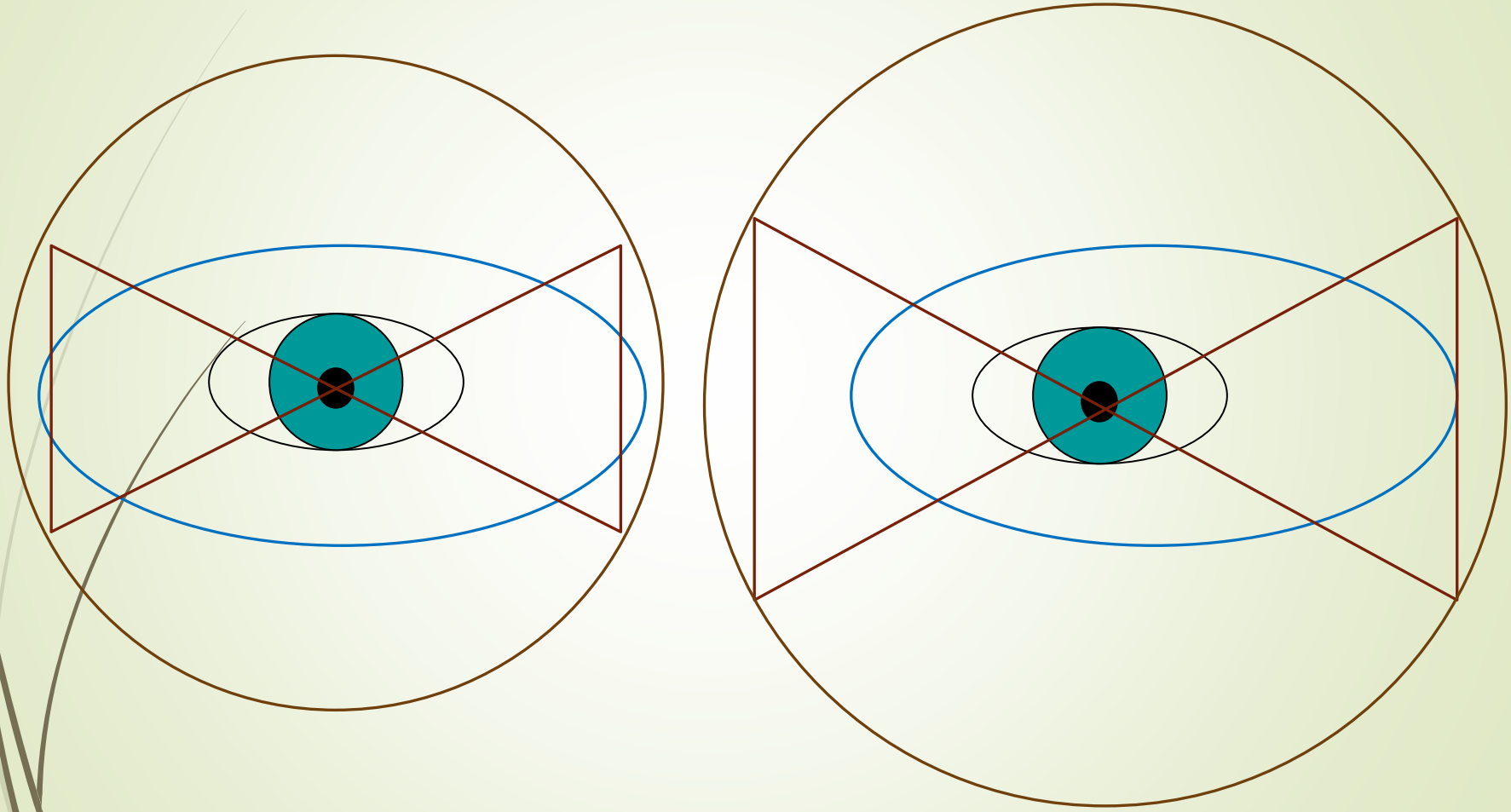
Consider Decentration
Vertical as well as Horizontal

Prism

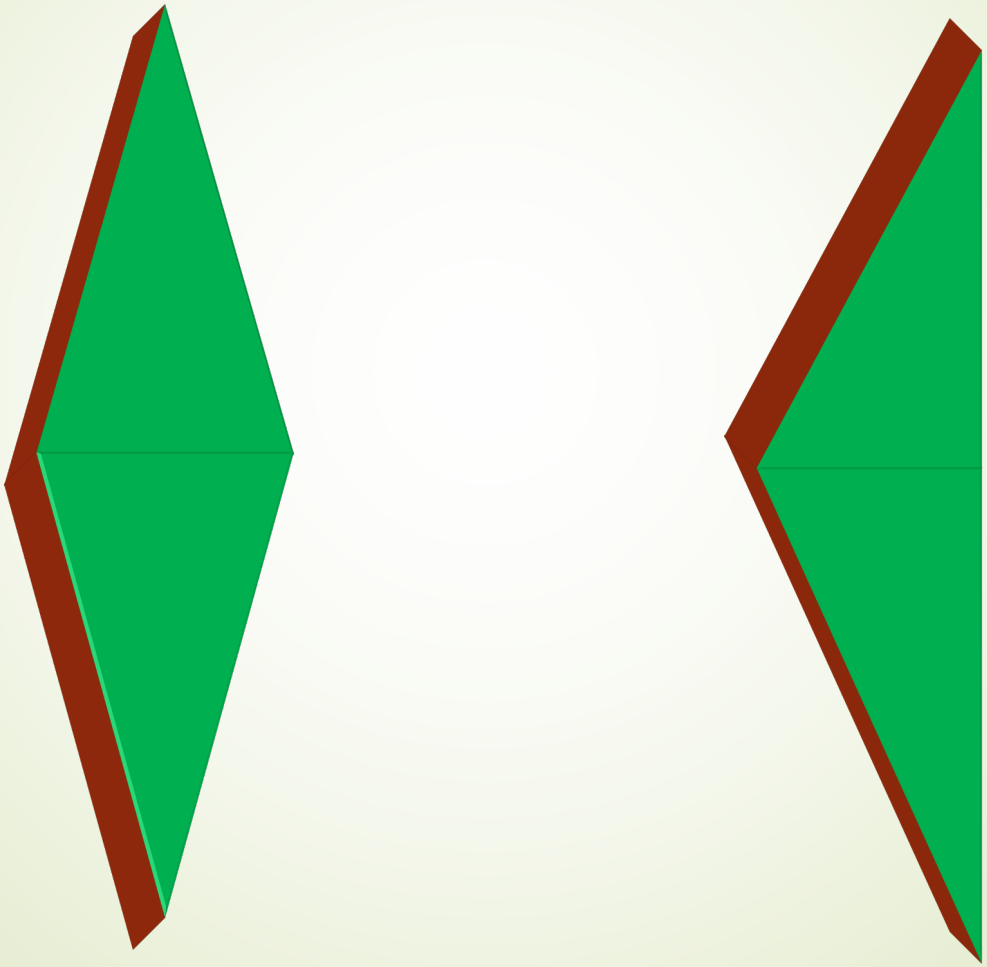


Properties of minus lenses

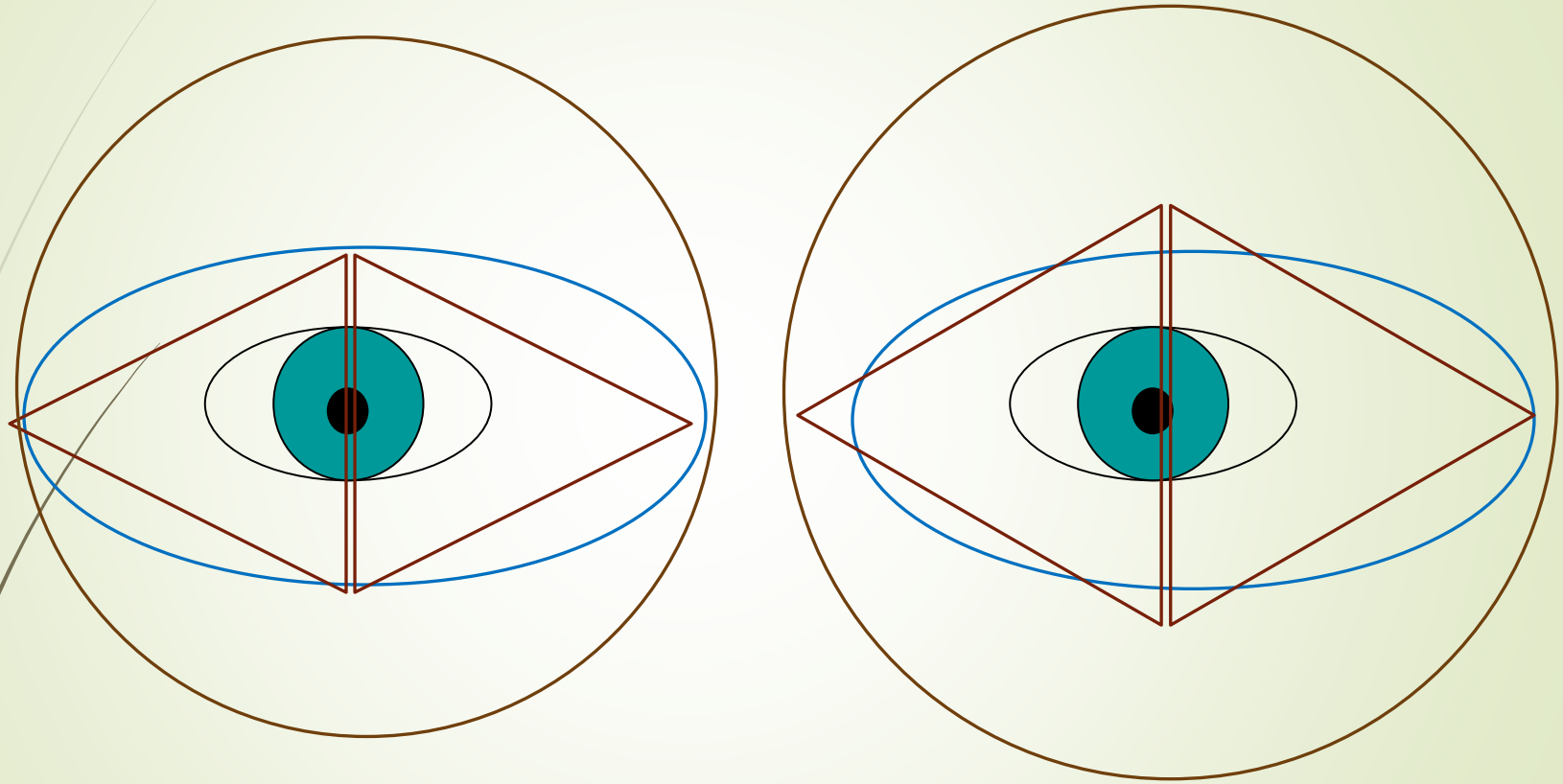
Decentration of minus lenses



Properties of plus lenses



Decentration of plus lenses



Identifying Lenses

- SV
- Multifocal
- PAL's
- Combinations
- How will the eyewear be used?

Comments/Questions/Answers

Thank You